CIRCULAR No. 26. S. P. I. No. 17.

United States Department of Agriculture,

DIVISION OF BOTANY.

EGYPTIAN COTTON IN THE UNITED STATES.

Egyptian cotton forms one of the most important items among the fiber materials imported into this country. In length of staple it is between the average upland and the sea island cotton. It is fine, but its particular value lies in its superior strength and elasticity, and in its remarkable development of twist, enabling it to cling together and make a very strong, fine yarn. When obtained in good condition it has a fine luster and is soft and oily to the touch. It is not handled well by the same machinery used for preparing and spinning upland cotton, and as it is used in the production of a quality of fabric not made from either upland or sea island cotton, it does not compete directly with them. It is used chiefly, either combed or carded, for the production of fine yarns. These yarns are used in the better qualities of hosiery and knit goods and for mixing with silk and wool. It is also used in making fine thread for laces.

IMPORTATIONS.

The direct importations of Egyptian cotton increased from less than 200,000 pounds in 1884 to more than 43,000,000 pounds in 1896. Since the latter date the importations have fallen off somewhat. This decline, however, must be ascribed to small crops in Egypt rather than to lack of demand. While there was a decline in the average prices during 1898 and the first part of 1899, there has been a decided upward tendency during the six months ended February 15, 1900, quotations in Boston reaching as high as 19½ cents per pound. The following table, compiled from reports of the Bureau of Statistics of the U. S. Treasury Department, shows the increasing consumption of Egyptian cotton in this country.

Imports, values, and prices of Egyptian cotton, 1890–99.

Year ended June 30—	Quantities.	Values.	Average price per pound.	Year ended June 30—	Quantities.	Values.	Average price per pound.
	Pounds.				*Pounds.*		
1890	2,947,741	$460,535	$0.156	1895	29,931,948	$2,798,272	$0.094
1891	10,186,345	1,376,258	.133	1896	43,574,769	5,129,256	.117
1892	16,763,723	1,856,885	.111	1897	37,323,249	4,277,618	.114
1893	28,121,282	2,924,722	.104	1898	38,165,061	3,555.708	.093
1894	18,338,900	1,930,987	.105	1899	37,506,062	3,712.224	.099

The above table represents only the cotton imported directly from Egypt and the values and prices at the port of shipment. Considerable amounts of Egyptian cotton are undoubtedly imported through other countries, and the prices in this country range higher than do those at the foreign ports of shipment. The requirements of the growing knit-goods industry and the demand for a quality of goods that can be made only from Egyptian cotton seems likely to maintain or even increase the demand for this fiber. The area supposed to be adapted to the cultivation of this cotton in this country is comparatively small, and there is apparently little danger of overproduction from other sources. It is cultivated in Egypt only in the Nile Delta, an area comprising altogether less than 10,000 square miles of arable land, or about one-third the area of South Carolina.

EARLY EXPERIMENTS WITH IMPORTED SEED.

The first records of attempts to cultivate Egyptian cotton in the United States seem to be the reports of trials with seed imported and distributed by the Department of Agriculture in 1867. The reports of the Department for 1867 and 1871 contain the results of more than fifty trials made in all of the States from North Carolina to Texas and Alabama. The cotton proved generally unsatisfactory, except in one or two instances in southern Louisiana. It was found to be drought-resistant, and in cases where mature fiber was obtained it was generally regarded as of superior quality. It required too long a season from seeding to maturity to permit its successful cultivation except in the extreme southern parts of the area. In many instances the plants grew large, and they were generally more free from attacks of insects or fungous diseases than upland cottons growing in the same regions. The bolls were mostly 3-locked, always small, and often few in number. Many of the bolls produced failed to mature before frost, so that the yield of fiber obtained did not average much more than one-third of the yield obtained from upland cottons. The most favorable reports were from southern Louisiana. There were no reports from southern Texas, and the single report from Florida was indefinite.

The reports of the failures in 1871 appear to have discouraged further attempts at the introduction of Egyptian cotton during the succeeding twenty years. Some seeds have doubtless been brought from Egypt by

private parties, but they have evidently not succeeded well, as nothing has been heard from them.

RECENT EXPERIMENTS.

During the years 1892 to 1894 the Department of Agriculture imported and distributed three varieties of Egyptian cotton seed, viz, Mitafifi, Bamia, and Abbasi. Seeds were sent to all of the cotton-growing States, where they were tested at the State Experiment Stations, and also on the plantations of several cotton growers. The reports received indicate failure in nearly all cases. Most of the men who tried the seed were so discouraged by the small yield of the first crop that they did not save seed to make any further trials. In most cases further trials would doubtless have resulted in a waste of time, but in the Gulf region, where the seasons are long, it is probable that better results could have been obtained from seed grown for two or three generations in this country. Experiments with imported cotton seed in this country and with American cotton seed in Egypt prove that larger yields may be expected after the plants become acclimated. The causes of failure were chiefly a too short season, except in the warmer part of the cotton belt, and seed not yet acclimated.

In San Patricio County, in southern Texas, Mr. W. H. Wentworth sowed 1½ acres each of Bamia and Mitafifi. He obtained from the first seeding only 75 pounds of seed cotton from the 3 acres, but he observed that the fiber was of superior quality and the plants were strong and healthy. Seeds were saved from selected bolls from the best plants and planted the following and each succeeding year. The plants became more prolific as they were thus acclimated and carefully selected. It was found necessary to keep the cotton closely picked, as exposure to the weather in the open bolls destroys the peculiar luster and the oily feeling, which are regarded as very desirable in the best quality. It was also found necessary to gin the fiber with a roller gin to obtain the full length of the staple. When carefully handled, picked as soon as mature, free from dirt, pieces of leaves, or "squares," and properly ginned on a roller gin giving a long even staple, free from seed hulls, Egyptian cotton grown in Texas appears to be fully equal to the imported fiber. A sample of cotton of the crop of 1899, sixth generation, grown in Texas, has been pronounced by some of the most extensive importers of Egyptian cotton in this country to be of superior quality. No spinning tests have yet been recorded.

In 1895 Mr. Wentworth cross-pollinated Mitafifi Egyptian cotton with Myers's Big Boll, a Texan variety, and has carefully selected seeds from the best plants resulting from the hybrid thus obtained. This hybrid cotton produces a fiber almost like the Egyptian, and in some respects is superior to the Egyptian. The bolls, although usually 3-locked, are generally larger than those of the Mitafifi, and the plants are more prolific and earlier maturing.

VARIETIES.

Mitafifi.—The best known variety and the one most extensively grown in Egypt is Mitafifi. This is commonly regarded as the standard variety in Egypt, and its fiber is most frequently quoted in the market reports in this country. It is one of the most hardy varieties, withstanding a comparatively wide range of climatic conditions. The Egyptian cottons as a rule are very sensitive to cold or excessive moisture. It attains a height of 4 to 7 feet, with numerous spreading branches. As it is generally larger than American upland varieties, it requires more room for development. It has rather small, round bolls, in which the cotton remains compact after the bolls are open. Its yield in Egypt under average conditions is 500 to 600 pounds of lint per acre, the lint being about 34 per cent of the seed cotton. The fiber is of a yellowish-brown color, fine, strong, soft, oily, and lustrous. The seeds are nearly smooth and black, with small tufts of green fiber at the ends, and are easily separated in ginning.

Bamia.—Next to Mitafifi, Bamia is one of the most extensively cultivated varieties. It attains a height of 6 to 8 feet, with coarse, stout stalks, but with few or no branches. The bolls are borne in clusters on short spurs similar to those of the cluster type. It may be grown somewhat closer together than Mitafifi, but it requires more water. The lint is brown, similar to that of Mitafifi, but usually classed a little lower in market quotations. The seeds are smooth, of a light coffee color, and somewhat larger than those of Mitafifi. The yield of lint is about 32 per cent of the seed cotton. The yield per acre under average conditions is nearly as much as that of Mitafifi.

Abbasi.—In certain favorable localities Abbasi is regarded as the best variety, and where it is obtained at its best the fiber from the first two pickings of this variety usually brings the highest market price. It grows best on loamy soil. Its seed should be in the ground early in March, and it requires warm and rather dry weather during October and November to properly mature a complete crop. The Abbasi plant is similar to that of Mitafifi, from which it is derived through Zafiri, a variety now little cultivated, but it is generally smaller, with a more open spreading habit and fewer branches. Its small bolls are very sharp-pointed. The seed is smaller than that of Mitafifi, somewhat reddish, and with very little adherent fiber. The yield of fiber is 34 per cent of the seed cotton. It is snow white, fine, silky, but not as strong as Mitafifi, and generally lacks the soft, oily feeling of the brown cottons.

Janovitch.—This variety, originated as a sport from Abbasi, was first brought to notice in 1897. It is therefore not much grown as yet, but it is asserted to be by all means the finest cotton of the white, long-staple class ever produced in Egypt. The fiber is nearly equal to Sea Island in length, snow white, of a remarkably fine silky texture, and has the characteristic twist well developed. This variety is now being introduced into America for the first time, a considerable quantity of

seed having been secured for the Department of Agriculture through the efforts of Hon. Barbour Lathrop and Mr. D. G. Fairchild.

The following varieties are grown to a less extent in Egypt, and their cultivation seems to be diminishing: Ashmouni, Zafiri, Hamouli, Sea Island, Gallini, and Ziftawi. They are generally less productive than Mitafifi, and in most cases their fiber brings a smaller market price.

COTTON CULTIVATION IN EGYPT.

This subject is treated at length in Bulletin No. 42 of the Office of Experiment Stations, and only the most important points in that bulletin will be repeated here. All of the cotton produced in Egypt is grown under irrigation. Very little rain falls in the Nile Delta from the time cotton seed is planted in March until the last picking in November. The temperature rises from an average maximum of 73° F. in March to an average maximum of nearly 95° in August, declining to about 74° in November. The average minimum temperatures are about 25° lower. The air is exceedingly dry during the entire year, and especially during the early growth of the cotton. The relative humidity increases from May to November, but never becomes as great as that in the cotton belt of the United States. The earliest and best pickings are matured in a very hot dry atmosphere, and the later pickings become successively poorer as the moisture increases and the heat declines. The irrigating water is under a control limited only by the supply. Flooding the lands while the cotton is maturing increases the moisture in the atmosphere from the abundant evaporation. The soil temperature at this time is from 80° to 86°, and the conditions are such as to induce rapid development in vegetable growth.

The soils where all of the best cotton is produced are clay loams produced by alluvial deposit from the overflow of the Nile. They are rich in fertility from the Nile deposits, and their quality is further improved by the extensive growth of Egyptian clover, adding nitrogen and humus. Phosphoric acid and potash are usually present in sufficient quantities and are not applied in the form of commercial fertilizers. Lime and magnesia are also present in the soils. Nitrogenous manures are generally found most beneficial, especially where cotton and sugar cane are grown to the exclusion of clover and other leguminous crops.

Cotton usually follows clover in a rotation of crops. The land is plowed and stirred to a depth of about 13 inches, giving a deep, mellow seed bed. The surface is made compact and firm by a plank drawn over it like a harrow, the driver standing on the plank giving sufficient weight to crush lumps and level uneven places. A level, even surface is essential for good results in irrigated land. Ridges about 35 inches apart are made with a plow, and the seeds, after soaking twenty-four hours in water to hasten germination, are planted in hills 14 to 20 inches apart on the sides of these ridges. The cotton is thinned to two plants in a hill and hoed usually three times, being watered after each

hoeing. After the third hoeing it is watered at intervals of twelve to fifteen days, until the time of the first picking, about the last of August, and it is watered again after the first and second pickings.

CONDITIONS IN THE UNITED STATES COMPARED WITH THOSE IN EGYPT.

Experiments in the cultivation of Egyptian cotton in this country heretofore indicate plainly that there is little hope for success with this crop except in the South Atlantic or Gulf coast regions or in the irrigated lands of southern Arizona or California. The seasons elsewhere are too short for its complete maturity. The following tables afford means for comparing these regions with the cotton-producing region of Egypt:

SOILS.

Analyses of soils in Gulf region and California.[1]

	Red pebbly clay, Gonzales County, Tex.	Sandy prairie loam, Harris County, Tex.	Tidewater live-oak soil, Terrebonne Parish, La.	Upland brown loam, Leon County, Fla.	River bottom land, Merced County, Cal.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Insoluble matter and silica	74.370	83.973	81.505	87.490	77.002
Potash	.446	.291	.767	.767	.569
Soda	.077	.197	.089	.019	.094
Lime	.389	.653	.631	.266	1.316
Magnesia	.209	.272	.552	.105	.547
Brown oxid of manganese	.043	.174	.018	.077	.036
Peroxid of iron	9.623	2.401	3.822	1.456	9.078
Alumina	7.944	6.079	7.247	6.885	5.090
Phosphoric acid	.233	.156	.105	.222	.132
Sulphuric acid	.106	.075	.365	.033	.094
Water and organic matter	6.093	5.313	4.400	4.053	5.991
Total	99.533	99.584	99.501	101.373	99.949

[1] Taken from Tenth Census of the United States, 1880. Vols. 5 and 6, Cotton Production.

Analyses of typical cotton soils of Egypt.

[From Bulletin No. 42, Office of Experiment Stations.]

	1.	2.	3.	4.	5.	6.	7.
	Per cent.	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*	*Per cent.*
Insoluble matter and silica	61.01	57.01	58.58	57.97	58.17	59.11	60.78
Potash	.72	.87	.67	1.88	1.85	1.75	.82
Soda	1.31	.79	.79	2.16	1.89	1.94	1.51
Lime	3.34	2.27	3.28	3.39	8.02	7.86	4.45
Magnesia	1.99	2.95	2.73	2.57	3.27	3.10	2.79
Iron oxid	9.84	11.69	11.33	9.78	5.47	5.61	10.21
Alumina	12.66	14.47	13.03	11.68	8.68	7.62	9.84
Phosphoric acid	.25	.36	.24	.29	.70	.55	.28
Sulphuric acid	.22	.19	.25	.36	1.66	1.83	1.24
Chlorin	.89	.12	.77	1.60	1.53	1.50	.91
Manganese oxid	.09	.06	.13	.21	.09	.12	.11
Carbon dioxid	1.05	.48	1.17	1.05	4.11	4.77	2.41
Organic matter	6.62	8.38	6.99	6.90	4.51	4.19	4.64
Nitrogen	.479	.205	.115	.436	.206	.202	.26

It will be observed in these tables that the soils indicated from this country contain a much higher percentage of insoluble matter and silica and a smaller percentage of mineral plant food than do those of Egypt. These differences are especially noticeable in lime, soda, potash,

and phosphoric acid. There is also a relatively smaller proportion of organic matter in the American soils. All of these elements may be supplied by means of fertilizers and by plowing under green crops. They are already present in sufficient quantities to produce a crop, providing other conditions are not unfavorable, and their extensive addition in the form of commercial fertilizers is recommended only after careful trial experiments on each farm have proved that the increased yield or the improvement in the land is sufficient to warrant the extra expense. In soils like those represented, applications of barnyard manure or an increase in the humus will doubtless produce a larger growth and a larger yield of cotton. Although cotton has never been cultivated in the irrigated lands of the West sufficiently to be regarded there as an important staple crop, yet it has been grown to a small extent in southern California since the earliest historic records of that region. It thrives there under irrigation. It has been stated that while the fiber of common upland cotton, grown under irrigation in California, is slightly shorter than that of the same variety grown in Georgia, it is finer and fully as strong. It has further been proved that a fair crop of cotton may be obtained on land too strongly alkaline to produce wheat. A saline soil and a saline atmosphere are held to be beneficial in the production of the best quality of Egyptian cotton.

TEMPERATURE.

A comparison of the temperatures shown in the following tables indicates that in the Gulf region the mean maximum temperatures are generally slightly lower than those in Egypt, while the mean minimum temperatures are higher. In Arizona the mean maximum temperatures are much higher, while the mean minimum are lower. The average temperatures are doubtless high enough for the Egyptian cotton to grow to full maturity in all places mentioned, except possibly central California, where the spring months are colder than the corresponding months in Egypt.

Average monthly mean maximum and mean minimum temperatures, degrees Fahrenheit.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Egypt	67.3	73.4	73.0	82.4	90.0	92.2	96.0	94.4	87.8	81.6	74.6	67.8
	43.9	50.8	50.6	58.0	63.3	65.3	69.8	70.7	55.6	60.8	55.4	50.2
United States. (a)												
Jacksonville, Fla	62.7	67.6	71.3	80.5	87.7	87.9	90.9	92.0	87.8	79.5	75.3	62.1
	44.3	46.8	50.4	59.6	67.7	71.9	73.6	73.5	70.6	61.2	59.5	45.6
New Orleans, La	61.5	65.8	70.0	76.1	82.0	87.2	89.1	88.2	84.8	77.3	68.4	63.3
	47.3	51.2	55.1	61.9	67.8	74.1	75.7	75.5	72.1	63.4	53.9	48.7
San Antonio, Tex	61.0	67.2	72.5	80.4	85.3	90.9	94.6	93.3	87.8	80.7	69.6	64.7
	40.8	46.2	51.6	59.2	65.0	71.4	72.9	72.2	67.6	59.2	48.3	44.8
Corpus Christi, Tex	61.0	67.3	68.6	75.2	80.0	84.2	87.1	86.4	83.6	78.4	69.8	65.7
	48.2	55.7	55.7	65.6	70.4	75.1	76.4	76.1	72.1	65.6	56.3	52.7
Brownsville, Tex	67.3	71.7	75.9	82.2	86.4	90.4	91.4	91.5	87.7	83.2	74.7	70.3
	50.0	55.0	59.6	66.1	70.6	75.0	76.4	75.1	71.8	66.7	57.4	52.9
Phœnix, Ariz	65.7	71.7	81.6	86.8	94.6	104.2	107.3	104.7	99.2	90.1	78.4	73.4
	32.2	35.8	41.0	46.3	53.1	60.4	71.6	71.1	60.6	50.2	42.4	36.6
Fresno, Cal	59.8	66.6	66.8	66.3	77.5	95.4	100.9	95.9	87.7	81.1	62.8	58.4
	41.5	40.3	45.8	43.1	50.3	61.8	69.1	63.8	57.4	52.3	43.5	40.2

a From statistics furnished by the Weather Bureau. The upper line in each case represents the mean maximum and the lower, the mean minimum.

HUMIDITY.

The atmosphere in Egypt is much drier than it is at any of the places noted in the table for this country. This dry air undoubtedly affects the growth of the plant and the development of the fiber, and it has been claimed to be essential to the production of luster, strength, and fineness, such as are found in the best quality of Egyptian cotton. The humidity of the Salt River Valley in Arizona during the months when fiber is developing does not differ much from that of Egypt during the same period. Careful experiments conducted in other regions may prove that too much has been claimed in this respect for the dry air of Egypt. Furthermore, the relative humidity among the rank-growing plants in the cotton fields, where the moisture is being rapidly given off from evaporation of the water used in surface irrigation, must be greater than that indicated by the figures in the table, which are taken to indicate the average of all of the atmosphere.

Monthly mean relative humidity, in percentages.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Egypt	41.1	34.1	34.1	30.1	24.7	32.4	34.8	43.6	44.1	46.5	52.8	52.5
United States. (*a*)												
Jacksonville, Fla	79.1	78.6	74.1	72.3	73.0	77.6	78.6	80.9	82.9	79.8	82.2	82.6
New Orleans, La.	79.4	80.9	76.4	76.0	74.2	78.1	78.3	78.8	77.3	74.0	79.4	79.6
San Antonio, Tex	65.6	63.8	62.1	67.7	69.6	67.3	64.0	65.2	68.8	63.7	65.3	62.8
Corpus Christi, Tex	74.7	74.0	72.9	74.9	73.2	73.2	72.9	73.3	72.7	70.3	72.3	73.3
Brownsville, Tex	80.3	80.0	80.1	77.8	78.8	76.6	76.1	77.0	80.3	79.4	79.8	81.1
Phœnix, Ariz	52.3	48.9	50.9	45.9	35.6	34.3	40.6	47.0	39.4	40.2	43.4	55.5
Fresno, Cal	81.6	71.7	69.8	59.3	52.7	42.4	34.7	34.7	43.6	55.1	64.1	83.2

a From statistics furnished by the Weather Bureau.

RAINFALL.

The greatest differences of conditions affecting plant growth are found in the rainfall. Cairo, near the upper or southern end of the Nile Delta, has a total average rainfall of only 1½ inches per year, and Alexandria, on the coast, has less than 8 inches. Nearly all of this small amount falls during the winter months, so that the crop is produced practically without rain. When there is a sufficient supply of water for irrigation the Egyptian planters prefer that there should be no rain at all on the growing crop after it has passed the second leaf. The small amount of rainfall in southern Arizona and central California indicates conditions favorable to the production of a good quality of fiber in those regions. The rainfall in the Gulf region does not prevent the production of a good crop, as has been proved by experiments before referred to i uthern Texas and Louisiana.

Average rainfall during different months.

	Jan.	Feb.	Mar.	Apr.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
Egypt.													
Cairo	0.22	0.10	0.12	0.10	0.01	.....	.....	.....	.....	.....	0.64	0.31	1.50
Alexandria	1.86	.63	.98	.07	.05	.....	.....	.....	0.09	0.11	1.77	2.24	7.80
United States.(a)													
Jacksonville, Fla.	3.1	3.0	3.6	2.7	3.8	6.1	6.2	6.7	8.2	5.2	2.7	2.8	54.1
New Orleans, La.	5.1	4.4	5.3	5.2	4.8	6.7	6.4	6.0	4.6	3.3	4.1	4.4	63.3
Austin, Tex	2.2	2.4	2.5	3.0	4.2	2.7	1.8	2.7	4.2	2.7	2.7	2.3	33.4
Galveston, Tex	3.6	3.0	2.9	2.8	3.7	4.9	3.1	5.3	6.0	4.2	4.3	3.9	47.0
Phœnix, Ariz	.6	.8	.7	.3	.2	.1	1.0	1.0	.5	.4	.5	1.0	7.1
Fresno, Cal	1.5	1.3	1.4	1.2	.4	.1	.....	.....	.2	.4	1.0	1.8	9.3

a From statistics furnished by the Weather Bureau.

If the production of Egyptian cotton is to succeed on a commercial scale in the United States it must be in the Gulf coast region, where the crop will have to withstand the conditions of uncertain rains, perhaps supplemented with irrigation, or in the irrigated lands of the Southwest. In the former region cotton cultivation is well established and labor is comparatively cheap. In the regions where irrigation is practiced, farmers and laborers alike are generally unused to the cultivation of cotton on a large scale, wages are generally higher than in the cotton belt, and the field crops grown are such as require less hand labor than is involved in the "chopping," hoeing, and picking of cotton. The most promising means for the successful production of Egyptian cotton in this country appears to be either in developing improved hardy and productive varieties that will withstand the conditions in the Gulf coast region, particularly its western part, or in devising methods of culture in the irrigated lands that will require less hand labor. It will be necessary in either case to keep up a continual selection of seeds in order that the quality of the fiber may be kept up to the highest possible standard.

LYSTER H. DEWEY,
Assistant Botanist.

Approved.
JAMES WILSON,
Secretary of Agriculture.

WASHINGTON, D. C., *March 16, 1900.*

18743——2

O